GLAST Monthly PSR

Safety and Mission Assurance

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Project Lead QE: Tavi Alvarez/Honeywell
GSFC ACD QEs: Alton Lacks, Stan Boyer/Honeywell
Software QE: David Harmon/Tybrin
QE at Spectrum Astro: Mark Kunda/Honeywell
QE at SLAC: Tracy Shepherd/Honeywell
Safety: Dave Bogart/PSM/302 & Jim Anderson/SRS
Reliability Engineer: Tony DiVenti/Honeywell
Parts: Thom Perry/QSS
Materials: Pilar Joy/541 & Fred Gross/Swales

October 2004

Safety and Mission Assurance

GLAST Software/IV&V

- Worked with Erik and Darren Marsh/SLAC QE to define SQA activities for the newly hired SQE at SLAC.
- GLAST Software Quality Assurance Plan is under CM review.
- Participated in spacecraft code walkthroughs and have requested the action items be sent to GSFC.
- Reviewed Spacecraft Flight Software (FSW) Design Document requirements traceability..
- Attended LAT FSW Full Build Review at SLAC. Concerns include potential lack of off-nominal testing and a tight schedule that may not allow for test procedure walkthroughs. Encouraged by defect tracking tool being in place.
- Continuing Ground System Risk Management process.
- Gained access to the IV&V Technical Issue Memorandum tracking tool, PITS.

Safety and Mission Assurance

Reliability

Accomplishments

- Completed an investigation regarding the risks and corresponding mitigation approaches available to address whether the Ku-Band and GPS receiver L1 antenna patch solder joints will be capable of meeting their 5 year mission life requirements. A presentation was developed and presented to GLAST senior management.
- Completed phase 1 of an audit to review all LAT Parts Stress and Derating analyses. To date, all required analyses have been completed by the LAT team.
- Completed reliability reviews and recommendations for the alternative S-Band architectural designs being considered in place of the more complex pin-diode and electromechanical switching configuration. Detailed qualification and reliability prediction data from Merrimac was provided as part of this effort.
- Developed an approach to have all prudent LAT Worse Case Analyses completed by Integration Readiness Review.
- Completed another review of the LAT ACD FMEA with representatives from the GLAST Systems Team.
- Supported on-going reviews as required (e.g., MCDR, Polyfuse selection review)

Safety and Mission Assurance

Reliability (Continuing)

Issues/Concerns/ Upcoming Events

- Facilitate timely closure of all outstanding LAT WCA activity prior to Integration Readiness Review.
- Need to approve GD/SAS and CMC Electronics' plans to use up-screened Fujitsu capacitors in place of newer capacitors being produced that will have corrective actions incorporated to eliminate cracking failures seen previously as a result of thermal cycling.
- Facilitate timely resolution/concurrence with GD/SAS and CMC Electronics regarding RF solder joint risks. Need to validate solder joint integrity for a 5-Year mission life. Resolutions plans are in progress.
- Support qualification/acceptance/resolution actions needed to insure all non-heritage items (e.g., SADA, APM) and newly identified parts issues (e.g. Actel FPGAs, ASIC ESD sensitivity, etc.) will not impact mission reliability.
- Improve integration of mission/observatory PRA analyses with current risk management and mission planning activities.

Safety and Mission Assurance

Reliability (Continuing)

Issues/Concerns/ Upcoming Events

- Complete phase 2 LAT Parts Stress and Derating Analysis Audit by reporting all known anomalies to both GLAST and LAT Management.
- Complete all required CDRL and RFA reviews/responses as requested.

Safety and Mission Assurance

Parts & Materials

- The weekly radiation telecoms held at 1:00PM on Thursdays between SLAC, NRL, ACD, Codes 561, Code 562 and the Glast Project Office have been replaced with PCB telecons. There have been a total of three PCB telecons held during this time period. The PCB has been actively updating the 19 GLAST subsystem parts lists via the telecons. The initial PCBs have concentrated on SLAC issues with the ASICs, TEM and TPS subsystems because the flight builds are starting.
- Attended various project level meetings to address the Actel FPGA issues with their RT54SX32S and 72S product lines. A total of 111 of these devices are used in the LAT, GBM, and the spacecraft. Also attended (via WebEx) the Actel meeting at GSFC in Bldg. 11 on Wednesday, September 22, that was sponsored by Rich Katz.
- The Code 562 T&A Laboratory is screening an additional 2200 MAX145AEUA ADCs for the GLAST project. Previously last year, 1000 parts were screened and qualified in the lab. Two shipments (371 and 492) of screened flight parts have already been sent to SLAC. The balance will be shipped to NRL when screening is completed for use in the Calorimeter.
- Submitted a work request to the Code 562 T&A Laboratory for the screening of 20 Winchester JF1P1S95B connectors that was subsequently expedited to meet ACD's build schedule. These were special order connectors with a specified 50 microinch (min.) gold plating on the contacts. One of the connectors was cross-sectioned, and the gold plating thickness was determined to be 59 microinches.

Safety and Mission Assurance

Parts & Materials (Continuing)

- The formal radiation review of the GBM instrument was finally completed when Code 561 received responses via Code 562 from Jena-Optronik and ASTRIUM regarding the radiation tolerance evaluation of the GBM Detector and Power Box parts.
- Prepared a new S&Q specification for the screening and qualification of 250 Raychem RXE250 Polyswitches that are used in the LAT DAQ.
- Submitted a work request for the IR testing of random samples from Novacap's replacement lot of 1210B563K251YHTM 250V ceramic chip capacitors. The original lot procured by NRL for the Calorimerter, Tracker, and DAQ subsystems did not meet IR specifications: parts were excessively leaky. Room temperature measurements on parts from the new lot averaged less than 3 nanoamperes, far below the 13.9 limit. Parts were also subjected to IR testing at +125C and passed. Based on this testing, the LAT PPE requested Novacap to release the screened parts to SLAC. Capacitors from the new lot will be used to complete the Tracker MCM builds and will also be used in the LAT DAQ subsystem.
- GBM had some RT54SX-S Actel FPGAs from early date codes (pre-0226) that had incorrectly sized transistors in three of the circuits that were subsequently overstressed during burn-in, jeopardizing the reliability of the parts. GBM decided to replace these with new product.
- Details of numerous parts activities since the last SAM quarterly are available at http://www.nepp.nasa.gov/index_nasa.cfm/699.

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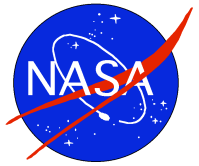

Parts & Materials (Continuing)

- **Issues & Concerns**
  - There are only three concerns:

    1. Actel FPGAs
    2. Actel FPGAs
    3. Actel FPGAs

Safety and Mission Assurance

Safety

- Reviewed the LAT Van de Graaff Accelerator Safety/Operations Handbook and provided comments recommending addition of Warnings and Cautions in the checklist
- Range Safety and KSC Safety comments have been received relating to the Preliminary MSPSP. Responses are being prepared and will be presented at an upcoming Safety Working Group.
- Approved revisions to the ACD Mechanical Handling Procedure
- Attended Test Readiness Review for the ACD Electronics Chassis EMI test. Emi testing begins 10/04/04.
- Audited Bldg. 2 PMT lab, found no safety issues
- Attended successful GLAST MCDR

Safety and Mission Assurance

QE Resident at SLAC

Accomplishments

- Performed Pre-shipment review and inspection of Lockheed Conductance heat pipes (CCHP's). Completed with no problems.
- Attended Manufacturing Readiness Review for General Technologies. (supplier manufacturing the Tower Power Supply-TPS and the Tower Electronics Module-TEM)
- Cal Module FM01 has successfully completed EMI / EMC and vibration testing with no issues.
- The trial assembly of Tower A (reclassified as Tower 0) progressed. All of the trays are stacked and cables are installed. Cosmic Ray data is currently being taken.
- Flight Software review was held on September 16th, 04.

Safety and Mission Assurance

QE Resident at SLAC

Issues and Concerns

- Tracker Multi Chip Modules (TMCM's) being assembled at Teledyne Electronics are being shipped to SLAC with numerous workmanship discrepancies. SLAC management and GSFC Resident are currently implementing a plan to re-inspect, document, and rework (if required) all discrepancies evident on previously delivered CCA's (approx 300 assemblies).

- A second iteration on a redesigned pitch adapter is in progress, to solve the problem of trace cracking. The masking is now being extended all the way over the bend region, and alignment is being improved in the assembly. Inspection of pitch adapters post burn in is being performed at SLAC to determine whether new cracks have developed throughout the assembly process.

Safety and Mission Assurance

QE Resident at SLAC

Issues and Concerns continued

- - Tungsten tiles were etched and primed in both the USA and Italy. The Italian company doing the etching found that they had to remove 6 microns of material from the thin (rolled tungsten) tiles to find pristine metal. This is a good indication of what was causing the bonding problems and why the thick tungsten tiles worked much better than the thin (the thick tiles were sintered tungsten and were precision ground to the desired thickness). The first coupon peel test was performed at GSFC. The results are hard to interpret, so GSFC will be repeating the test with unprimed tungsten for comparison. The peel tests in Italy should be completed by 9/27/04

Safety and Mission Assurance

QE Resident at SLAC

Upcoming Events

- Quality Survey at Glen Air (Supplier for Electronic harness and cables)

- First Article inspection of TEM/TPS Circuit Card assemblies at General Technologies

- Site visit at Teledyne electronics. Purpose of visit is to discuss previous workmanship issues.

Safety and Mission Assurance

GLAST Spacecraft (Page 1 of 2)

Accomplishments

- The resident Quality Engineer (Mark Kunda) is currently performing detailed part inspection both in house and at local suppliers. No major rejections have been identified, but minor dimensional discrepancies have been identified and documented. 7 flight parts inspected, with 11 minor discrepancies. All will be use as is.
- Resident QAE continued reviewing plans, and procedures in addition to any Material Review Board (MRB), and or Failure Review Board (FRB) actions. Eleven (7)) new Quality Assurance Rejections were reviewed, all were class 2, and 0 were rejected. Included in both inspections and review of the QAR is all tooling, fixtues used for generation or inspection off observatory dimensions,

Issues and Concerns

- Actel, the supplier of the FPGA (Field Programmable Gate Array), has experienced a post programming failure. A Tiger team has been established to determine the use of “S” or “U” level parts. At this point no determination has been given due to the validation of the level of testing and the level of reliability of these parts. Spectrum Astro has decided to use commercial parts to continue production, and when the final decision is made the parts will be changed out.

Safety and Mission Assurance

GLAST Spacecraft (Page 2 of 2)

Issues and Concerns

- Nickel flakes in the transistor can is causing shorts. A previous failure (NFIRE Program) at Spectrum has now been determined to be from the metallic nickel flakes. Spectrum is waiting for direction from the GPO at GSFC. Spectrum's position is that this part and process is far reaching and has an impact on almost all parts/assemblies.

- DC/DC converter rework for the die bond failures has been stopped due to the decision to re make the lot of parts. Multiple wire bond failures has provided enough information to warrant a new lot of parts.

- Emcore, the supplier for the Solar arrays, has experienced a failure on the welds used to join the stings of cells. Failure investigation has produced several leads to the cause all have been implemented with no success. A permanent Process Engineer is being considered to take residency at Emcore until the process is established and working. At this point there is not direct root cause, therefore the investigation I on-going.

Safety and Mission Assurance

In-House LAT Subsystem: ACD

ACD Tile Shell Assembly (TSA)

During the Base Electronics Assembly (BEA) Lift Sling Interface Proof Test, the safe working load for the ACD lifting sling and the BEA lift brackets were exceeded.

This problem was a result of a discrepancy between the load cell and load cell read-out.

A close call report and PR was generated and closed.

The load cell/ read out and lift sling re-certified.

Tile Shell Ass'y (TSA) has been proof load tested with the BEA lift sling.

The TSA has been integrated onto the Base Frame Ass'y in the Big Top Clean Room .

The mechanical fit check of the ribbon cables and tile detectors has begun, in preparation for installation onto the Tile Shell Ass'y.

Electrical harness installation and instrumentation nearly complete.

Safety and Mission Assurance

In-House LAT Subsystem: ACD (Continuing)

Tile Detector Ass'y

An MRB was convened to discuss the corrective action concerning the Tile Detector design errors in which the wave shift fibers exited the wrong end of tiles.

A decision was made to have tiles detectors hole locations re-drilled and plugged at Fermi Labs.

The tiles were modified and shipped back to GSFC for testing.

The tiles passed light tight testing and were fit checked on the TSA with no issues.

ACD Photomultiplier Tubes

During thermal cycling re-emergence of 9 cracked tubes when going cold(-15 to-30 degrees c) and assembly process halted.

Investigative panel reconvened to evaluate and determine root cause of problem.

The ACD project is looking at a possible re-design of flight housing configurations, along with other tests of glass tubes.

A recovery plan is being developed in building 30 to salvage the potted glass tubes in housings.

19 PMT's installed into Qualification chassis for electrical checkout.

One PMT tube was found to be noisy during H/V check. The noisy PMT is under investigation. A PR has been generated.

The PMT glass breakage issue, several solution paths are being considered

Safety and Mission Assurance

In-House LAT Subsystem: ACD (Continuing)

a.) Whether to use primer on glass and a release agent on the grooved inner housing to minimize stresses of the RTV.

b.) A mechanical design without RTV which reduces stress on the PMT housing and glass.

c.) De-bond or remove the PMT housing from the RTV by machining and remove the RTV from the glass by solvent.

A decision has been made on the PMT crack glass issue, to go with implementing the partial co-efficient thermal expansion design.

Thermal and vibration tests were performed on 8 proto-flight tubes in various mechanical configurations, with no anomalies.

The results of these tests reinforced the selection of this design.

A Peer Review was held on 8/30/04 to discuss the crack glass issue.

The ACD project is leaning towards the partial CTE design without the use of RTV, but little quantitative analysis was done on this design. The Peer Review team suggest pursuing a parallel path.

They recommend looking at the grooved housing design using release agent for the RTV and qualifying both designs.

At the present time 11 PMT's with the partial CTE spring design were thermal cycled twice at Qual levels of + 45degrees Celsius and –40 degrees Celsius successfully.

10 PMT''s of the 11 PMT's because of fixturing were vibrated at Qual levels survived vibration testing.

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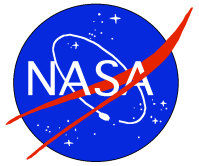

In-House LAT Subsystem: ACD (Continuing)

These 10 Qual tubes are presently in thermal Vac testing and has seen 3 of twelve cycles at +45 to –40 degrees Celsius with no anomalies.

A second group of twelve Qual PMT's is in thermal cycle, eight of which are potted tubes with release agent in grooved housings, and four tubes are spring compensation design.

Two PMT's which had RTV potting debonded from glass tubes in bldg. 30 were sent to bldg. 2 for electrical test failed. At this time all debonding operations are halted, until problem can be identified.

The two tubes s/n's AA0199 and AA0114 were sent to Hamamatsu for analysis. A PFR was written.

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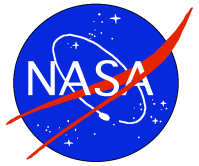


In-House LAT Subsystem: ACD (Continuing)

ACD High Voltage Bias Supply Boards

All HVBS boards have completed T/V testing and were sent to building 2 for electrical testing.

During electrical checkout of the Qual chassis, excessive noise was discovered when turning on the high voltage.

It was determined through further investigation the H/V currents were returning through the FREE boards, instead of the 28 volt return line.

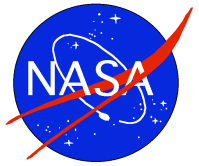
All work stopped on Qual chassis until H/V problem was resolved.

The corrective action was to add bi-pass capacitors on the H/V boards to reduce the noise.

The H/V boards were tested in the power branch and passed.

The H/V boards were sent to building 2 for assembly into Qual chassis and testing.

Safety and Mission Assurance

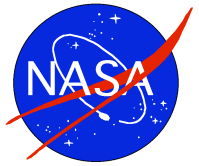


In-House LAT Subsystem: ACD (Continuing)

ACD Qualification Electronic Chassis

- Qual chassis assembled and tested with flight boards and 19 PMT's..
- During electrical checkout one PMT exhibited excessive noise. When turning on the H/V, noise was exhibited from H/V board..
- All testing stopped until H/V noise problem is resolved.
- Qual chassis de-integrated to remove noisy PMT tube and H/V boards
- H/V board noise issue re-solved, and Qual chassis re-assembled with 18 flight PMT's and modified H/V boards.
- Noisy PMT under investigation.
- Qual chassis ready for re-test.
- Qual chassis electrical functional tested and passed.
- Qual chassis ready for software integration and test.

Safety and Mission Assurance



In-House LAT Subsystem: ACD (Continuing)

ACD Problem Report/Problem Failure Report Status

- A total of 92 PR's have been generated.
- 85 PR's have been closed.
- 0 PR's open passed 90 days old.
- A total of 8 PFR's) are open .
- 2 PFR's open passed 90 days.
- 2 PFR's closed

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